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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/594,638	06/15/2000	Rajaroo Jammy	99P7722US03 (8055-98 DIV)	9880

7590 05/16/2003

Siemens Corporation  
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EXAMINER

GHYKA, ALEXANDER G

ART UNIT

PAPER NUMBER

2812

DATE MAILED: 05/16/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/594,638

Applicant(s)

JAMMY ET AL.

Examiner

Alexander G. Ghyka

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 22 April 2003.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 18-34 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 18-29 is/are allowed.
- 6) ☒ Claim(s) 30-34 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.  
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).  
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 2) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_ 6) ☐ Other: \_\_\_\_\_

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### DETAILED ACTION

#### *Claim Rejections - 35 U.S.C. § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103© and potential 35 U.S.C. 102(f) or (g) prior art under 35 U.S.C. 103(a).

3. Claim 30-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kasai et al (EP 0 684 637) in view of Ho et al (US 5,643,823).

4. Claims 31-34 generally require a trench capacitor comprising a crystalline silicon substrate having a surface formed in the substrate, the surface being substantially free of native oxide; a crystalline silicon nitride layer, formed on the surface of the trench; and an amorphous silicon

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nitride layer formed on the crystalline silicon nitride layer. Various dependent claims further set for the thicknesses and composition of the layers.

5. Kasai et al discloses the formation of a trench **33** on a semiconductor wafer **31** with the insulative film **32** used as a mask so as to expose single crystal Si on the inner surface of the trench. Next impurity is doped into the exposed single crystal Si and a single crystal doped with impurity is formed on the inner surface of the trench. See column 6, lines 15-25. Kasai et al also disclose the removal of the natural oxide film, and disclose the formation of a thermal nitride film of 2 nm to 5 nm. The thermal nitride film is formed by introducing  $\text{NH}_3$  in the chamber at 800 to 1200 degrees Celcius at low pressure. See column 7, lines 1-15. Next a CVD silicon nitride film is formed on the thermal nitride film **35** and the insulative film. See column 8, lines 20-30 and Figure 3.

6. Therefore, the Kasai et al reference differs from the presently claimed invention in that it does not disclose the thermal nitride layer is crystalline.

7. Ho et al (US 5,643,823) disclose the application of thin crystalline  $\text{Si}_3\text{N}_4$  liners in shallow trench isolation structures. Ho et al discloses that a high temperature rapid thermal anneal in pure ammonia conducted at 1050 degrees Celcius to 1100 degrees Celcius results in a crystalline silicon nitride film. See the Abstract.

8. One of ordinary skill in the art, at the time of the invention, would have found it obvious to arrive at the presently claimed limitations as it would have been obvious to one of ordinary skill

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in the art that the thermal nitride of Kasai et al would be in crystalline form, as the Ho et al reference discloses that a silicon nitride film produced by high temperature exposure to ammonia is in crystalline form. Therefore, a *prima facie* case of obviousness has been established.

***Allowable Subject Matter***

9. Claims 18-29 are allowed.
10. The cited prior art does not disclose the hydrogen baking step as required in the aforementioned claims.

***Conclusion***

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Alex Ghyka whose telephone number is (703) 305-3407. The examiner can normally be reached on Monday through Friday from 9:30 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John F. Niebling, can be reached on (703) 308-3325. The fax phone number for the organization where this application or proceeding is assigned is (703) 308-7722.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

AGG

May 12, 2003

ALEXANDER GHYKA  
PRIMARY EXAMINER

Av 2812  
*Alex Ghyka*